PROGRESS REPORTS
FROM
EXPERIMENT STATIONS

SEASON 1953-54

TANGANYIKA TERRITORY
EASTERN PROVINCE

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TANGANYIKA TERRITORY
EASTERN PROVINCE

PROGRESS REPORT FOR THE SEASON 1954

COTTON SEASON.

Planting: February to April.
Picking: July to November.
Legal uprooting dates by Districts:

Kilosa, Bagamoyo and Kisarawe	...	30th November.
Ulanga and Morogoro (Duthumi):	...	15th December.
Morogoro (except Duthumi) and Rufiji	...	30th December.

Rainfall: November 1953 to October 1954: 38·11 inches.

INTRODUCTION.

Ilonga Station.

Meteorology.—Rainfall was up to average but fell mainly in January, February and March. In April and May only light showers occurred. Cotton followed a December planted millet crop, *Panicum milliaceum* (harvested in March) and this probably affected cotton yields as it is doubtful if there is sufficient soil moisture available to harvest two good crops a year.

Staff.—Mr. R. Smith arrived in February on transfer from Nyasaland. Mr. E. W. Valentine went on vacation leave in November. Work has carried on with co-operation from members of the Colonial Agricultural Insecticides Research Unit and the Agricultural Department staff.

Visitors.—Ilonga has been visited by Mr. J. C. May, Sir Geoffrey Clay, Mr. J. E. Peat and members of the Department of Agriculture during the past year; the Eastern Province Cotton Committee held a meeting and members were shown the effects of insecticide applications and better cultivation. Two parties of native cultivators also visited the station and it is hoped that this will become a regular part of the station's activities.

Eastern Province Cotton.

Cotton growing areas in Eastern Province are diffuse and, owing mainly to the geography of the province, tend to be situated in isolated blocks. Consequently, each area needs to be treated on its merits. District plots with one or two cultivation trials, a variety trial and investigations on the pest problem in each area should provide the answers for localised conditions.

In general during the 1954 season much cotton was late planted owing to the bad distribution of rain at planting time and late preparation of land. Pests (mainly American bollworm) were present, but heavy attacks occurred only in localised areas in most districts. The degree of attack was probably related to the amount of maize planted in an area and the pattern of crops and cultivation in time and space in that area.

47/10 was grown in the Mngazi and Kisaki areas of the Duthumi ginnery zone.

General Conclusions.

It was shown during the season that insecticide applications were economically profitable on Ilonga when cotton was well tended and that the 'Swaine' duster* is the best gun to use under local conditions.

Early planted cotton (dusted and not dusted) gave significantly the best yields. The yields obtained from late planted (April) cotton did not cover the cost of insecticide, where this was used. Improved cultivation methods need encouraging in most districts of the Eastern Province before the use of insecticides, to control heavy bollworm attacks, can become an economic possibility. The entomologist's main line of enquiry in the coming season will be to assess crop losses due to pests in native grown cotton gardens. Also, he will attempt to estimate the possible profit from pest control, where gardens are planted at various times, where the efficiency of cultivation differs from plot holder to plot holder and where the system of agriculture has introduced other variants (e.g., previous cropping, interplanted cotton with maize, etc.).

There is considerable variation in yield, ginning percentage and lint length within the cotton grown in the Eastern Province.

Plant Breeding

BY

R. SMITH.

The season at Ilonga, on the whole, was a good one, despite the early cessation of rain in May. The later formed bolls dried up on the plant, probably owing to lack of soil moisture, and no top crop was picked. All the cotton was dusted with 10% DDT and 3% BHC at approximately 8 lb. per acre; no excessive care was taken but control was good. The dusting resulted in a quick maturing crop, senescence occurring with rapid defoliation at the end of July. An area of non dusted cotton kept its leaves and produced bolls and flowers until it was uprooted on 16th November. Fruiting was slower in this non dusted cotton and none of the bolls formed during August and September produced any grade I cotton; stainers, pink bollworm and drought were the main contributing factors, it is believed, in stopping the formation of a late crop. The percentage of total cotton for each pick in the dusted and non dusted areas is shown in Table 1.

*As described in the East African Agricultural Journal, Vol. XX, No. 1, July 1954.

TABLE 1.

Amount of cotton harvested at each pick, expressed as percentage of the total cotton picked, for dusted and non dusted cotton.

Pick:	1st	2nd	3rd	4th
Date:	4th August	18th August	4th September	10th November
Dusted:	67%	30%	3%	—
Non Dusted	43%	39%	14%	4%

The 4th pick was all grade III cotton.

Spacing—Time of Planting.

February planted cotton gave a considerable increase in yield over all other treatments. Planting after the end of March gave a negligible yield. This applied equally to dusted and non dusted cotton.

February planting enables the crop to flower during March and April when the rainfall expectation is the greatest and also allows time during the rains for refilling if this is necessary. An earlier crop can be picked and a longer close season enforced, thus reducing pink bollworm populations and avoiding stainers.

In the native system of agriculture priority is given to food crops. The land is prepared in November and December and sorghum, millet, maize, etc. planted as soon as sufficient rain falls in December or January. Land for cash crops (cotton, sunflower, etc.) is then opened up and prepared, and planted between February and the end of April, depending on the individual, the season, and the land he is cultivating.

In the case of the cotton grower, it would be better if he opened up and prepared all his land in December, before the food crop planting rains. Then, if rain comes early in February he could plant his cotton without any delay. If, however, he has to prepare his land for cotton in February and then no adequate planting rain falls until late March or April, his yields will be considerably reduced, whether bollworm is present or not.

The results indicate that a closer spacing than 3 ft. × 3 ft. with 2 plants per hole would give increased yields, especially when insecticides are used.

This trial was planted well away from maize and a relatively high yield was obtained from the early planted non dusted treatment, in spite of the loss of the later crop from lack of soil moisture, stainers, pink and spiny bollworm. Thus, good cultivation is equally as important as insecticide application. It is hoped that control of insects will encourage the better native farmers to improve their cultivation methods.

TABLE 2.

SPACING—TIME OF PLANTING.

2 trials (one dusted with 10% DDT and 3% BHC weekly May and June) each of 6 blocks with 8 treatments, 1/203·3 acre per plot, 3 ft. ridges, tied, spacing of control 3′ × 3′ with 2 plants per hole.

SEED COTTON IN LB./ACRE.

Treatments.			*Dusted.*		*Non Dusted.*	
Between plants	Plants per hole			ABW/10 plants per week.		ABW/10 plants per week.
6″,	1		1114	1·37	733	8·22
12″,	1		1125	1·26	663	3·78
18″,	1	March	1000	0·83	602	2·49
36″,	1	planted.	669	1·26	566	2·52
36″,	2		784	0·98	608	1·96
36″,	3		917	1·31	657	1·31
36″,	2	Feb. planted.	1300	0·95	1006	1·90
36″,	2	April planted.	28	0·72	42	1·44
Sign. Diff. (P. = ·05)			159		140	
S.E.		±	55		± 49	

Selection and Testing.

Raingrown Types.—In the Eastern Province, Local is being replaced by 47/10, which, although of better quality than Local, has a lower ginning outturn. The general breeding programme, at the moment, is to obtain a strain with high yielding capacity and improved ginning outturn that can still produce marketable lint under poorer growing conditions than those at Ilonga.

This past season all the selections on the station made before 1952 were tested in variety trials—a total of 116 strains. The selections made before 1949—a total of 23 strains—were also tested at four district plots, but yields from these were very disappointing.

From all these strains, 39 selections made in 1951 were sent for spinning tests. Twelve of the pre-1949 selections from Ilonga and from each of the district plots were also sent. Of all strains, 48 will be put into trials again next year.

200 selections made in 1953 were planted in small bulks. 35 have been kept for trials next year.

400 new selections have been made this season.

Irrigation Types.—The possibility exists that a large irrigation scheme may develop in the Rufiji valley. It is hoped that a pilot scheme will start in 1956, to provide initial information.

For this, seed of a number of strains of Egyptian type cotton has been obtained from the Sudan and will be planted at Lupiro in the Kilombero valley this coming season, to compare them with long staple Upland types from Eastern Province cotton.

Further, 250 selections have been taken from the present raingrown crop, the only criterion being longer lint. It is hoped that some of these strains will eventually be tested in the Rufiji, and that a good strain will be available by the time the irrigation scheme starts, with lint qualities approaching the Sudan types.

Variation within the Crop.—In all, this season, 1,676 single plant selections were made and each one was ginned and combed. Tables 3 and 4 show the distribution of variation for these characters among these selections.

TABLE 3.

Variation of lint lengths in mm. for strains ginning at 29% and over in 1954 single plant selections.

Lint Length	Less than 32	32	33	34	35	36	37	38 and over
No. of selections in each group	85	38	68	94	148	48	22	43

TABLE 4.

Variation of ginning percentages in 1954 single plant selections.

Ginning %	Less than 28	28	29	30	31	32	33	34	35	36	37 and over
No. of selections in each group	315	236	309	320	207	139	77	40	22	6	5

The distribution of variation in yield of lint per acre is shown in Fig. 1 for the strains selected in 1951 and grown in variety trials at Ilonga. There is sufficient variation to provide better strains, with all requisite characters.

Seed Coat Nep.—Counts of seed showing damaged chalazal tips indicate that although damaged seeds are present, the proportion is below 20% for the majority of strains in most places. This character will have to be watched, however, especially as the proportion seems to vary considerably from place to place.

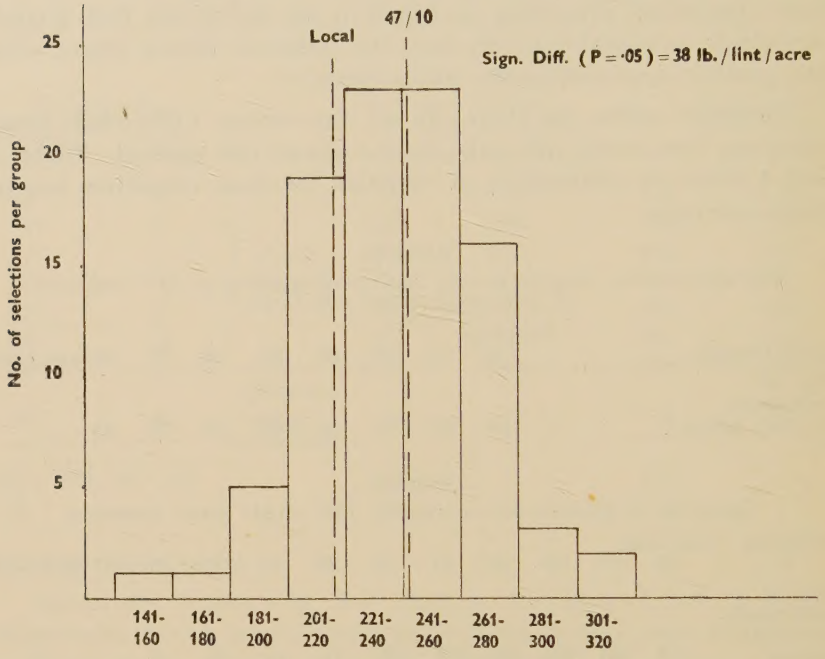
TABLE 5.

SEED COAT NEP. PERCENTAGE OF DAMAGED SEED.

Strain.	*Ilonga.*	*Mvomero.*	*Duthumi.*
Local.	3	15	33
47/10	4	8	8
45/12	6	6	22
45/4	15	3	13
48/36	3	17	25
48/67	2	15	12

FIG. 1.

VARIATION IN LINT YIELDS, ILONGA 1954, IN 1951 SELECTIONS.



ENTOMOLOGY.

BY

E. W. VALENTINE.

This year the investigations into the control of cotton pests on Ilonga Research Station were conducted by officers of the Colonial Agricultural Insecticides Research Unit, while the Empire Cotton Growing Corporation entomologist co-operated in some of the trials by making observations on the insect populations, and also by carrying out some preliminary trials on the practicability of insecticidal control of pests in native grown cotton.

Acknowledgment is given to Mr. G. A. Jones, Chemist (C.A.I.R.U.), and Mr. K. S. McKinlay, Entomologist (E.A.A.F.R.O.), for information and the summary of results included in this report.

American Bollworm (*Heliothis armigera*).

Field Sampling.—As in former years the first records of bollworm larvae were obtained from early planted and volunteer maize. Small numbers were recorded during January and February, but high

numbers were not found until the beginning of March on January planted maize.

Records taken during the period mid March to early July, on maize planted in mid January, early March and late March, show that egg laying continues for approximately three weeks after the first silks begin to open and that larvae can be found feeding on the silks and cobs for five to six weeks, taking the crop as a whole. In each successive crop the numbers of larvae recorded were lower, possibly due to the effect of control by parasites, and to the population becoming distributed over a wider area including attractive cotton as well as maize.

Eggs and larvae were recorded in cotton in mid May, six weeks after planting. At the end of this month the populations had reached approximately 1,500 larvae per acre, and there were 5,000 flared squares per acre, the point at which insecticide treatments were begun. During the next three weeks the populations in untreated plots rose rapidly to peaks of from 4,600 to 15,750 per acre in different trials. Although the intensity of attack varied, the pattern was similar in each trial, beginning during May, rising to a maximum in the third or fourth week of June and then declining to negligible numbers by the middle of July.

While numbers of larvae were decreasing in cotton during July, large populations were recorded on chick pea. This crop was dusted, however, so that the length and intensity of infestation could not be recorded.

Pupation Periods.—Bollworm larvae collected from the field were allowed to pupate in open bottomed tins set in the ground, in order to determine pupation periods under as natural a condition as possible. The records confirm the findings of previous years in that during the first five months of the year pupation periods rarely exceed 20 days, but that pupations beginning during June and July, when the minimum temperature falls to below 60° F., can last as long as three months.

The distribution of pupation periods is shown in Table 6.

Table 6.

Distribution of Pupation Periods of American Bollworm, 1954.

Month of Pupation.	*Number of moths emerged.*	*Pupation periods in days.*							
		10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
January	6	6	—	—	—	—	—	—	—
February	37	35	2	—	—	—	—	—	—
March	15	13	2	—	—	—	—	—	—
April	331	315	11	5	—	—	—	—	—
May	179	172	2	—	—	—	—	—	—
June	63	40	22	1	—	—	—	—	—
July	130	64	32	6	10	2	11	4	1

At the time of the last emergences, in October, no bollworm larvae could be found in cotton or other hosts at Ilonga, and a search of riverside maize, the most likely site of infection near Ilonga, did not reveal their presence. Many other known hosts including sunflower, pigeon pea, regenerated sorghum and *Tridax procumbens* were also searched intensively without success. Recording will be continued in an attempt to find those hosts on which bollworm is able to carry over from one season to the next, and to investigate the possibility of a much longer pupal diapause.

Spiny Bollworm (*Earias spp.*).

This pest was recorded in all trials sampled, from the first week of June, and remained at relatively low and variable numbers until late July when there was a rapid increase in both treated and untreated cotton. The numbers recorded did not show that one treatment gave better control than any other. The difficulty in assessing the effect of insecticidal treatment on *Earias* populations is that egg laying is dependent on the attractiveness of the plant. It seems that where American bollworm has been adequately controlled the state of the plant is such as to attract a greater number of adults than where plants have been heavily damaged.

Early in the season, before cotton became attractive, spiny bollworm larvae were recorded on both indigenous and cultivated species of *Hibiscus,* and after the cotton season on *Abutilon sp.,* and *Hibiscus.*

Pink Bollworm (*Platyedra gossypiella*).

Pink bollworm was present in large numbers in early planted cotton only. Plots planted on 23rd February were sampled for bollworms from mid April when the pink bollworm population was 2,000 per acre. This reached a maximum of 8,000 per acre in early May despite application of insecticide, but had fallen to a negligible level later in the month. A search was made for possible sources of infection, which were found to be principally an *Abutilon,* which carried very high populations, and to a lesser extent volunteer cotton plants in the fallows. Larvae were also recorded during September and October in the second growth of cotton plants which had been heavily attacked by American bollworm. By this time all other cotton had been picked and uprooted.

Stainers (*Dysdercus spp.*).

At no time during the season were stainers present in great numbers, and as most of the cotton was picked and uprooted by the end of August, the time at which larger populations are expected, they were of little account.

Aphids.

Aphids were troublesome all over the farm, and were responsible for a marked reduction in yield where they were not controlled. At the beginning of insecticidal treatment the level of infestation was relatively low, and declined slightly in the first three weeks of application. In the following four weeks however the intensity of attack increased rapidly so that in plots inadequately controlled all plants were affected. The treatments which were found to be most efficient in checking the build-up of aphids were Endrin and the higher concentrations of BHC. Although these treatments killed the parasites and predators, as did the other treatments, they were also effective in controlling the aphids themselves.

Time of Planting and Spacing Trial.

Records of bollworm were taken in the undusted plots of a time of planting/spacing trial conducted by the plant breeder (Table 2), with the object of trying to find the relative attraction of cotton plants grown at different spacing and populations per acre.

The counts for bollworm population show that where plant populations are the same, the infestation is higher if the plants are more evenly spaced. This seems to indicate that the egg laying moth is attracted more to evenly spaced cotton. The environment in dense growth may also be more suitable for larval development, as there would be less variation in temperature and humidity, and may also afford more protection from parasites and predators. Yield increases from dusting were greater in evenly spaced plants so that in the absence of an insect attack more evenly distributed single plants should give a higher yield.

The seasonal larval population in February planted cotton was only slightly less than in that planted at the same spacing in March, but at the time of bollworm attack, the earlier plants held a more mature bottom crop which was not severely attacked.

These investigations are only preliminary and will be continued in more detail next year.

Dusting Trial on Native Grown Cotton.

This was a small preliminary trial to investigate the practicability and economics of dusting native cotton.

Two plots of $\frac{1}{4}$ acre each were marked out on each of six African gardens near Ilonga, and one plot on each garden was treated with 10% DDT/3% BHC dust at 8 lb. per acre for 8 weekly applications, using the Swaine duster.

Results from these gardens are tabulated in Table 7.

Table 7.

Summary of yield from dusting trials in native grown cotton.

(Yields in lb. of seed cotton per acre. Approximate value of cotton and profit in shillings per acre. Grade I 1/30 per kilo; Grade III –/32 per kilo. Cost of dusting, Shs. 96/- per acre.)

		Dusted.		*Undusted.*		*Nett Profit from*
		Yield.	*Value.*	*Yield.*	*Value.*	*Dusting.*
			Shs.		*Shs.*	*Shs.*
Well grown	1.	1188	659	584	291	272
	2.	865	488	570	285	106
Poorly grown	3.	508	290	237	130	64
	4.	506	275	332	166	13
	5.	626	358	528	294	– 32
	6.	484	267	400	209	– 37
Average		690	390	441	229	64
		% Grade I: 93·2.		% Grade I: 84·5.		

These measures showed that adequate control of insect pests could be achieved. However, the chief importance of these trials lay in their demonstration of the effect of the standard of agriculture and time of planting upon the possible returns from the use of insecticides. Where the cotton was well grown, the profits were considerable, and conversely on poorly grown cotton the yield increases due to bollworm control were not sufficient to pay for the use of insecticide.

Main Conclusions from the Insecticidal Trials.

From a series of trials conducted by the Colonial Agricultural Insecticides Research Unit, the following information is summarised; full details of these experiments will be published later.

A number of different insecticides were compared, but only Endrin, at $\frac{1}{4}$ lb. per acre, proved better than DDT and BHC mixture. Endrin is cheaper and may reduce costs by half.

Various concentrations of DDT and BHC mixture were tried at varying frequencies of application but there was no treatment better than the present recommendation of 1 lb. DDT and $\frac{1}{4}$ lb. BHC per acre per week for eight weeks.

Protecting the cotton for various periods through the season showed that June is the critical month for bollworm control. By dusting in July and August as well further increases were obtained. Dusting in May and not in June, and dusting in July and August only (without June), gave poor control.

A large number of dusters were compared and the Swaine dusters at Shs. 5/- each proved as good and as easy to use as rotary dusters costing £10 each. A drift duster gave poor control.

APPENDIX.

Eastern Province Local.	The mixed commercial variety, mainly of Uganda origin.
47/10	A 1947 selection with good quality lint but low ginning outturn. It is being multiplied for distribution throughout the Eastern Province to replace Eastern Province Local.

Received February 1955.

T. BUNCLE AND CO. LTD., ARBROATH.